

OFFICE OF LIFE AND MICROGRAVITY SCIENCES AND APPLICATIONS (Code U)

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The total Fiscal Year 2001 budget request for the Office of Life and Microgravity Sciences and Applications is \$302.4 million.

NASA's Office of Life and Microgravity Sciences and Applications (OLMSA) seeks to advance scientific knowledge, enable the development of space for human enterprise, and transfer the knowledge and technologies that are developed as broadly as possible. We seek to enable and exploit the possibilities of human space flight and improve the quality of life for people on Earth. OLMSA's program of research and technology development and commercial investment in space relies upon broad participation by researchers from academia, government, nonprofit and commercial sectors. OLMSA fosters the involvement of the private sector in space by establishing policies and providing expert support to companies. OLMSA is an integral component of NASA's Human Exploration and Development of Space (HEDS) Enterprise, which pursues the following goals: expand the frontier; expand scientific knowledge; enable and establish permanent and productive human presence in Earth orbit; share the experience and discovery of human Space flight; and expand commercial development of space.

Bioastronautics Initiative

In the field of biomedical research, OLMSA proposes to augment activities already underway in order to ensure the health, safety, and performance of humans in space by accelerating research and development of "countermeasures" (diagnostics, therapy, preventatives, and rehabilitation methods) to maintain the health of flight crews on long duration missions and transfer this knowledge and technology to benefit health on Earth. Bioastronautics research is an interdisciplinary set of focused research activities bringing together biology, physics, chemistry, communications technology and nano-technologies that will revolutionize medical care delivery in space and on Earth. This research will produce technologies that will benefit health care. A significant portion of the Bioastronautics Initiative will support biomedical research and development work sponsored by the National Space Biomedical Research Institute (NSBRI). The technology aspect of this program will rely on our cooperative activities in these disciplines working together with NIH and other organizations as appropriate to leverage resources, insure technology transfer for health care and enhance synergism. The OLMSA projects contributing to this Initiative are Advanced Human Support Technology, Biomedical Research & Countermeasures, Microgravity Research and Health Research (Space Medicine Research).

Advanced Human Support Technology \$30.9 million

The goals of Advanced Human Support Technology (AHST) are to demonstrate and validate: full self-sufficiency in air, water, and food recycling capabilities for use in

space vehicles; integrated, fully autonomous environmental monitoring and control systems; and human factors engineering. In FY 2001, AHST will release the annual NRA and expand ground research to prepare to take advantage of the growing International Space Station (ISS) capability. Candidate technologies, including sensor technologies, for the BIO-Plex facility will be selected and the major test support systems buildup will continue. An engineering breadboard/prototype of a Vapor Phase Catalytic Ammonia Removal water recovery subsystem will be developed for integrated evaluation at JSC. A flight test of the Immobilized Microbe Microgravity Water Processing System will be conducted. A Preliminary Design Review for the ISS Integrated AHST Facility will be conducted. Ground tests of Space Human Factors equipment, including the Wireless Augmented Reality Prototype, will be conducted.

Biomedical Research and Countermeasures \$76.9 million

The goals of biomedical research and countermeasures (BR&C) program are to conduct research that defines and reduces risk to crew health from space radiation and acute and chronic health problems, and research that will increase crew productivity in flight, and ensure crew resumption to full, healthy life on Earth. In FY 2001, OLMSA will continue to expand research operations on the ISS. OLMSA is preparing a wide range of experiments for flight on the International Space Station in FY 2001 and developing an expanded research program to take full advantage of growing ISS capabilities into the future. Facilities for human research will be available to support this research as part of the continuing deployment of the ISS. OLMSA will complete testing and deliver radiation and soil and dust analysis experiments for inclusion on the Mars Surveyor Program 2001 orbiter and lander missions. Preparations will continue for participation in a Mars 2003 mission. The BR & C program will release its annual NRA. To support space radiation research, the Booster Application Facility (BAF) construction progresses towards completion with operational research beginning in FY2002.

Fundamental Biology (FB) formerly Gravitational Biology and Ecology \$39.2 million

The goals of fundamental biology (FB) are to determine the mechanisms by which the evolution, development, structure, and function of cells, physiological systems, organisms and ecosystems sense and respond to gravity and to develop fundamental knowledge to support the development of countermeasures and bioregenerative life support systems. FB uses a variety of gravitational environments as research tools or by determining the combined effects of gravity and other environmental factors on biological systems. During FY 2001, FB will support approximately 164 investigations, publish abstracts and reports of progress for over 90% of FY 2000 research investigations (tasks), make this publication available on the internet, and support a wider range of investigations in fundamental biology. FB will increase fundamental knowledge in biological and biomedical sciences and address critical questions in crew health and safety by conducting 6 to 10 ISS investigations. These will include continued investigations on the effects of gravity on plant growth and physiology, providing information on the effect of the space environment on bacterial virulence and

providing information on the effect of microgravity on skeletal myofibers. Fundamental biology research will also be conducted on the STS-107 Research Module mission, including studies of cells, plants and rats.

Microgravity Research \$129.260 million

Microgravity Research (MR) seeks to use the microgravity environment of space as a tool to advance knowledge and as a laboratory to explore the physical foundations of natural processes. The MR program includes sustaining leading-edge research focused in the areas of biotechnology, combustion science, fluid physics, fundamental physics, and materials science, fostering an interdisciplinary community to promote synergy, creativity and value in carrying out the research.

In FY 2001, MR will continue development and preparation for upcoming ISS flight research, perform focused research activities on the STS-107 Research Mission, and conduct three investigations using suborbital rockets. Research deployment aboard the ISS will increase with six flights occurring, setting the stage for future full utilization. MR will deliver thirty-three payloads in FY 2001. The payloads will support research investigations in the areas of biotechnology (macromolecular and cell science), materials science, fluid physics, and acceleration measurement. Research needed to generate low-gravity technology required to advance human exploration of the solar system will continue to expand and evolve. New research projects will be selected in Combustion Science and Fundamental Physics. Early ISS utilization will expand with science investigations being conducted on the Microgravity Science Glovebox and Express Rack. An increasing number of investigations will be undergoing final engineering readiness reviews in preparation for deployment in the ISS science research facilities.

In addition, MR will support the development of a second generation research announcement in biology-inspired technologies with the idea of bringing some of the more promising technologies to a point of maturity where they could support NASA missions. Potential areas include extending the capabilities of human interactions with machines through enhanced computational capabilities or improved sensor and data-handling capabilities, and the use of new biological materials or structural concepts inspired by biological functions found in nature. MR will support a NASA/National Cancer Institute (NCI) collaborative program to define the opportunities and research directions to advance the development of technologies and informatics tools needed to enable minimally-invasive detection, diagnosis, and management of disease and injury. As part of fundamental physics, MR will undertake the management oversight transferred from Mission Integration of the DOE sponsored Alpha Magnetic Spectrometer (AMS) mission including the Critical Design Review (CDR) and the first NASA integration hardware deliveries to the DOE/AMS payload developer.

Space Product Development \$13.6 million

The Space Product Development (SPD) Program facilitates the use of space for development of commercial products and services (including appropriate supporting

ground-based activities); couples NASA and private sector technology development to the advantage of both; and incubates commercial enterprises that use space on a profit-making basis. The SPD Program also promotes the benefits of space-based research to industry, facilitates industry's access to space, provides space research expertise and flight hardware, and advocates the development of policies to encourage commercial use of space. SPD includes support to the operation of the NASA Commercial Space Centers, and commercial flight research hardware for Shuttle. In addition, SPD provides parabolic aircraft flight opportunity and program support to hardware funded by the Space Station office and developed for the ISS.

The CSCs are partnerships of industry, universities, and local, state, and other federal agencies engaged in commercial space research for new or improved products using insights gained from the unique research environment of space. During FY 2001, Space Product Development will have as its goal the expansion of commitment from the private sector to invest in commercial space, as evidenced by at least ten new, active industry partners to the Commercial Space Centers. There are presently 159 commercial affiliates associated with 10 Commercial Space Centers. NASA will continue to be proactive in the development of policies and plans that foster commercial endeavors. As access to space is a key factor in obtaining and maintaining commercial sector commitment to and investment in space for product research, SPD will support planning and preparation for commercial space product research on the ISS and on Shuttle for flight opportunities as they become available.

Health Research \$11.3 million

Commencing in FY 2001, the previously separate Occupational Health Research and Space Medicine Research functional activities have been combined into one single budget structure entitled Health Research. The combination of Space Medical Research and Occupational health Research into Health Research focuses the Agency's health research and health care functions for its workforce under one program, the Office of Health Affairs, OLMSA. Research conducted under the revised program is expected to have potential applicability for both general employee health and the health of astronauts during space flight.

Mission Integration \$.240 million

MI performs the space-based research utilization planning of all OLMSA Space Shuttle and ISS payloads. In addition, MI carries out systems engineering efforts to develop and evaluate strategies and processes for satisfying current and future research mission objectives. In particular, the program is investigating ways to apply the engineering and operations lessons learned in the Spacelab program and the NASA/MIR Research Program (NMRP) to the ISS program to achieve greater efficiencies. The first Research Double Module (RDM) will be flown on STS-107. In the interim, science/research at the middeck locker equivalent (MLE) level will be flown on ISS assembly flights on a space-available basis.

Investments \$1.0 million

OLMSA is contributing to the HEDS Enterprise investment in higher education institutions, including the Nation's Historically Black Colleges and Universities (HBCUs) and Other Minority Universities (OMUs). The outreach fosters new

aerospace science and technology concepts by integrating HEDS cutting-edge science and technology concepts, practices, and teaching strategies into the Minority Institutions, thus increasing the production of more competitive trained U.S. students, underrepresented in NASA-related fields. Other activities focus on enhancing diversity in HEDS programs and activities by exposing faculty and students from HBCUs and OMUs and underserved schools to the Enterprise's research efforts and outcomes, educational programs, and activities.

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